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STUDY ON GROWTH PERFORMANCE OF BROILER SUPPLEMENTED WITH ORGANIC ACIDS IN THEIR DIET AS AN ALTERNATIVE TO ANTIBIOTICS

J. N. BANJADE[1], D. B. NEPALI [2], J. L. YADAV[3] & M. SAPKOTA[4]

[1]*Scientist, Nepal Agricultural Research Council, Regional Agricultural Research Station, Khajura, Banke, Nepal*

[2, 3, 4] *Professors, Institute of Agriculture and Animal Science, Rampur, Chitwan, Nepal*

ABSTRACT

An experiment was conducted in a completely randomized design to determine the effects of feeding organic acids as an alternative to antibiotics in the diet of broiler chicken at IAAS, livestock farm from February 20 to April 7, 2006. There were altogether 7 treatments replicated thrice and each experimental unit consisted of 10 birds. The treatments were Standard ration(SR)(T_1), SR + antibiotics (T_2), SR + 300 mg ascorbic acid/kg diet (T_3), SR + 0.02 % acify (T_4), SR + 0.03 % acify (T_5), SR + 300 mg ascorbic acid/kg diet + 0.02 % acify (T_6) and SR + 300 mg ascorbic acid/kg diet + 0.03 % acify (T_7). The commercial acidifier used was acify (0.2ml/lit, 0.3ml/lit of drinking water), chlortetracycline and ascorbic acid were used at the rate of 500 mg/kg and 300 mg /kg of feed.. The average weekly body weight for 3rd week was found significant (P<0.05) and maximum body weight (729.53 g) in broilers fed onT_7. A significantly higher (P< 0.05) live weight gain was observed on the third and the fifth week in broilers fed on T_7. The significant differences in feed consumption were observed, and maximum feed consumption (639.97 g), (865.0 g) and (1146.75 g) were observed in birds fed on T_3, T_6 and T_2 for the third, fourth, and sixth week respectively. Feed efficiency for the third week was significantly (p< 0.05) poor (2.03) in T_3.

KEYWORDS: Ascorbic Acid & Acify

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INTRODUCTION

Acidification has the potential of controlling all enteric bacteria, both pathogenic and non-pathogenic (Miller, 1987). Various organic acids including formic, fumaric, propionic and sorbic have been added to broiler feed resulting in positive response (Vogt *et al*., 1981). These acids may enhance growth and feed efficiency by eliminating organisms that compete with the bird for nutrients, a benefit attributed to antibiotics. However, the uses of antibiotics have caused some concern because of drug resistance (Bates *et al*., 1994). Organic acids in their undissociated forms are able to pass through the cell membrane of bacteria. Once inside the cell, the acid dissociates to produce +H ions which lower the pH of the cell causing the organism to use of its energy in trying to restore the normal balance, whereas the RCOO- anions produced from the acid can disrupt DNA and protein synthesis, putting the organisms under stress so that it is unable to replicate or replicate rapidly (Nursey, 1997). The lower pH conditions thus protect the animal from infection especially at young ages. In recent years, there has been an increased interest in the effect of organic acids on feed efficiency and bird performance (Pattern and Waldroup, 1988).[1]

The main objective of this study was to determine the effect of different types and doses of organic acids supplementation in the diet as an alternative to antibiotics on the overall performance and economics of broiler

production.

MATERIALS AND METHODS

The experiment was conducted at the Institute of Agriculture and Animal Science, livestock Farm, Rampur, Chitwan from February 20th to April 7, 2006.Two hundred ten, day old Vencobb broiler chicks were obtained from commercial hatchery and reared in battery brooder for one week. After brooding, chicks were transferred to experimental 3.3 m^2 sized pen. The experiment was conducted in completely randomized design (CRD), there was altogether seven treatments and replicated thrice. Each experimental unit consisted of 10 birds.

Two types of rations, one for broiler starter (0-4 weeks) and another for broiler finisher (5-6 weeks) were formulated. Both broiler starter and finisher ration contained 3000 ME kcal/kg, and 21 and 19 percent crude protein respectively. Both rations were fortified with powdered form of ascorbic acid. Chlortetracycline was also mixed in the ration 500 mg/kg of feed. The acidifier was fed to the birds through drinking water. The acidifier contained lactic acid, fumaric acid, citric acid, formic acid, citrate, oxine copper and essential oils.

Table 1: Percent Ingredients Composition of Broiler Starter and Finisher Rations

Ingredients	Starter Ration (0-4 Wks)	Finisher Ration (5-6 Wks)
Maize	55.20	59.40
Rice polish	4.00	7.47
SBM	29.60	26.20
Soya oil	1.80	0.80
Sunflower cake	5.30	2.50
Bone meal	2.72	2.33
Lime stone	0.56	0.53
Salt	0.25	0.25
Lysine	0.04	0.00
Methionine	0.18	0.17
Vitamin and mineral (Brovit)	0.20	0.20
Chekotox (Toxin binder) Zuricox (Coccidiostat)	0.10 0.05	0.10 0.05
Total	100	100

The composition of broiler rations is presented table 1. The feeding trial lasted for 42 days**.** The treatments were Standard ration (SR) (T_1), SR + antibiotics (T_2), SR + 300 mg ascorbic acid/kg diet (T_3), SR + 0.02 % acify (T_4), SR + 0.03 % acify (T_5), SR + 300 mg ascorbic acid /kg diet + 0.02 % acify (T_6) and SR + 300 mg ascorbic acid/kg diet + 0.03 % acify (T_7). The feed and water were offered *ad libitum* to birds and were vaccinated as scheduled.

The weekly feed intake, body weight and body weight gain were recorded. The data obtained from the study were analyzed statistically using MSTAT.

RESULTS AND DISCUSSIONS

FEED CONSUMPTION

The average weekly feed consumption of broiler (g / bird) fed diet with different levels of organic acids is presented in Table 3. The analysis of variance showed significant ($p< 0.05$) difference in weekly feed consumption in the 3rd, 4th, 6th week respectively. Significantly higher feed consumption (639.97 g) in third week was recorded in T_3 than T_2 and T_4 (611.50 and 618.33 g) respectively but it was at par with rest of the treatment. Whenever the birds are under

summer stress the feed consumption lowers, but due to the ascorbic acid supplementation in the diets, heat stress was lowered resulting in higher feed intakes. This is supported by findings of Mckee and Harrison (1995) who observed a significantly greater feed intake in chicks provided either 150 or 300 ppm ascorbic acid. Kutlu and Forbes (1993) reported that heat stressed broiler chicks provided with 200 ppm ascorbic acid consumed more feed than those not supplemented.

Likewise, for 4th week significantly higher feed consumption (865.00 g) was recorded in T_6 than T_3, T_2, T_5 (833.00, 835.17, 839.00 gm) but it was at par with T_4, T_1, T_7 (846.00, 850.00, 858.33 g) respectively. The birds consumed more feed in T_6 due to the better utilization of nutrients and combined effect of organic acid which might have resulted in increased body weight gain and hence increased consumption of feeds. The highest feed consumption (1146.75 g) was recorded in birds which were on T_2 diet and differed significantly with the values of T_3, T_4, and T_5, but it was at par with rest of the treatments which indicated that antibiotics were more influencing additive than either ascorbic acid alone or combination of ascorbic acid with acify during the 6th week of age.

Table 3: The Average Weekly Feed Consumption (G) of Vencobb Broilers Fed Diet with Organic Acids as an Alternative to Antibiotics

Treatment	Period (Week) and Feed Consumption (G)					
	2	3	4	5	6	Overall Mean
T_1 = Standard ration	377.67	629.50^{ab}	850.00^{abc}	1000.67^{a}	1113.33^{abc}	794.23
T_2 = SR + antibiotics	358.00	611.50^{c}	835.17^{c}	1015.83^{a}	1146.75^{a}	793.45
T_3 =SR + 300 mg aa/kg diet	363.00	639.97^{a}	833.00^{c}	950.00^{b}	1097.33^{c}	776.66
T_4 = SR + 0.02 % acify	366.00	618.33^{bc}	846.00^{abc}	1000.33^{a}	1090.33^{c}	784.20
T_5 = SR + 0.03 % acify	373.00	624.00^{abc}	839.00^{bc}	965.67^{ab}	1101.33^{bc}	780.60
T_6 = SR + 300 mg aa/kg diet + 0.02 % acify	369.33	634.00^{ab}	865.00^{a}	967.00^{ab}	1118.33^{abc}	790.73
T_7 = SR+ 300 mg aa/kg diet + 0.03 % acify	365.33	630.10^{ab}	858.33^{ab}	989.03^{ab}	1141.80^{ab}	796.92
LSD	ns	15.70	20.89	45.38	38.56	
CV %	3.17	1.43	1.41	2.63	1.97	
SE m ±	6.73	5.18	6.89	14.96	12.71	

Means within the column followed by the different superscript are significantly different (P< 0.05) by DMRT

BODY WEIGHT

The average weekly body weights of broilers fed diet with acify, ascorbic acid, antibiotics and without acify is presented in Table 4. Average initial body weight of broilers showed no significant differences among treatments. Significant difference in average weekly body weight was observed only in third week. The values for third week were 695, 680, 679, 714, 704.67, 720, and 729.53 g respectively for T1, T_2, T_3, T_4, T_5, T_6, and T_7. The highest body weight (729.53 g) of broiler was observed in T_7 and lowest (679.00 g) in T_3. These values differed significantly ($p< 0.05$). The highest body weight in T_7 might be due to acidifier which lowered the intestinal pH and might have increased the population of useful bacteria and decreased the population of harmful bacteria by the acidification of gut. In addition, ascorbic acid might have reduced body temperature and respiratory rates of broiler chicken that resulted in increased body weight at respective week. The result confirms to the findings of Langhout (2000) who reported that organic acids reduce production of toxic components by bacteria and change in the morphology of the intestinal wall and reduces colonization of pathogens on the intestinal wall, thus preventing damage to the epithelial cells.

Table 4: Average Weekly Body Weight (G) of Vencobb Broilers Fed Diet with Organic Acids as an Alternative to Antibiotics

Treatments	Period (Week) And Body Weight (G)						
	Initial Wt.	2	3	4	5	6	Overall Mean
T_1 = Standard ration	166.00	373.33	695.00^{bc}	1185.33	1623.00^{ab}	2028.00	1011.78
T_2 = SR + antibiotics	167.33	366.00	680.00^{c}	1168.00	1580.67^{bc}	2056.50	1003.08
T_3 =SR + 300 mg aa/kg diet	157.67	362.67	679.00^{c}	1156.00	1558.33^{c}	2002.00	985.95
T_4 = SR + 0.02 % acify	160.00	368.00	714.00^{ab}	1172.33	1605.67^{abc}	2053.33	1012.22
T_5 = SR + 0.03 % acify	165.00	376.00	704.67^{abc}	1168.33	1577.00^{bc}	2014.00	1000.83
T_6 = SR + 300 mg aa/kg diet + 0.02 % acify	171.33	384.67	720.00^{ab}	1200.33	1612.33^{abc}	2060.67	1024.89
T_7 = SR+ 300 mg aa/kg diet + 0.03 % acify	158.00	368.00	729.53^{a}	1188.00	1644.47^{a}	2077.87	1027.70
LSD	ns	ns	29.65	ns	54.03	ns	
CV %	4.40	3.18	2.41	1.96	1.93	2.32	
SE m $\pm$	4.15	6.82	9.78	13.34	17.81	27.39	

Means within the column followed by the different superscript are significantly different (P< 0.05) by DMRT

BODY WEIGHT GAIN

The average weekly weight gain of broiler fed on different levels of organic acid is presented in Table 5. The analysis of variance on average weekly weight gain of broiler showed statistically significant (P< 0.05) in 3rd and 5th week. In third week, a significantly higher body weight gain of broiler (361.53 g) was recorded in T_7 than T_1, T_2, T_3, T_5 (321.67, 314.00, 316.33, 328.67 g) respectively. However, the same value was at par with T_6 and T_4 (335.33, 346.00 g) respectively. The highest body weight gain might be due to better utilization of nutrient. Hadorn *et al*., 2000; Partanen *et al*., 2002 also observed acid combinations had an intensified response than in single acid.

Likewise, for 5th week also a significantly higher weekly body weight gain (456.47 g) was recorded on T_7 than T_3, T_5, T_6, T_2 (402.33, 408.67, 412.00, 412.67 g), but was at par with T_4 and T_1 (433.33, 437.67g) respectively. The acidic condition in broiler's digestive system allowed the establishment of specific pH and microorganisms particularly *Lactobacillus sps* (Sarra *et al*., 1985). The mutual situation between microflora and pH prevented *E. coli* growth and this condition makes the absorptive area more beneficial (Dofing and Gottschal, 1997). Acidic conditions make more nutrients available (Boling *et al*., 2001) which monitors better performance.

Table 5: Average Weekly Body Weight Gain (G) of Vencobb Broiler Fed Diets with Organic Acids as an Alternative to Antibiotics

Treatment	Period (Week) and Body Weight Gain (G)					
	2	3	4	5	6	Overall Mean
T_1 = Standard ration	207.33	321.67^{bc}	490.33	437.67^{ab}	405.00	372.40
T_2 = SR + antibiotics	198.67	314.00^{c}	488.00	412.67^{b}	475.83	377.83
T_3 =SR + 300 mg aa/kg diet	205.00	316.33^{bc}	477.00	402.33^{b}	443.67	368.87
T_4 = SR + 0.02 % acify	208.00	346.00^{ab}	458.33	433.33^{ab}	447.67	378.67
T_5 = SR + 0.03 % acify	211.00	328.67^{bc}	463.67	408.67^{b}	437.00	369.80
T_6 = SR + 300 mg aa/kg diet + 0.02 % acify	213.33	335.33^{abc}	480.33	412.00^{b}	448.33	377.86
T_7 = SR+ 300 mg aa/kg diet + 0.03 % acify	210.00	361.53^{a}	458.47	456.47^{a}	433.40	383.97
LSD	ns	27.58	ns	33.63	ns	
CV %	4.87	4.74	3.69	4.54	10.24	
SE m $\pm$	5.84	9.09	10.10	11.09	26.12	

Means within the column followed by the different superscript are significantly different (P< 0.05) by DMRT

FEED CONVERSION

The average weekly FCR with different levels of organic acids is presented in Table 6. The analysis of variance for feed conversion ratio (FCR) showed a significant difference ($P< 0.05$) in the 3rd week but was not significant during the rest of the study period. In the 3rd week significantly poor feed efficiency (2.03) was recorded in T_3 than T_7 and T_4 (1.75, 1.79) respectively which was at par with the rest of the treatments. The poor feed efficiency was observed in T_3, as it had higher feed consumption and had lower body weight gain at respective weeks and better feed efficiency was observed in birds fed on T_7 and T_4 diets. This might be due to the reduced bacterial numbers in the small intestine which resulted in decreased gut wall thickness and increased villi length and thus improved feed conversion. These effects helped to compensate for the removal of antibiotic growth promoter in diet. Rahmani and Speer (2005) reported that the feed conversion of broiler chick up to 21 and 42 days were 1.38 and 1.75, 1.43 and 1.81, 1.48 and 2.04 respectively for natural additive, organic acid and control group .

Table 6: The Average Weekly Feed Conversion Ratio of Vencobb Broilers Fed Diet with Organic Acids as an Alternative to Antibiotics

Treatment	Period (Week) and Feed Efficiency					
	2	3	4	5	6	Overall Mean
T_1 = Standard ration (SR)	1.83	1.96^{ab}	1.73	2.29^{ab}	2.77	2.12
T_2 = SR + antibiotics	1.80	1.95^{ab}	1.71	2.47^{a}	2.41	2.07
T_3 =SR + 300 mg aa/kg diet	1.77	2.03^{a}	1.75	2.37^{ab}	2.49	2.08
T_4 = SR + 0.02 % acify	1.76	1.79^{bc}	1.85	2.31^{ab}	2.45	2.03
T_5 = SR + 0.03 % acify	1.77	1.90^{abc}	1.81	2.36^{ab}	2.53	2.07
T_6 = SR + 300 mg aa/kg diet + 0.02 % acify	1.73	1.89^{abc}	1.80	2.35^{ab}	2.51	2.06
T_7 = SR+ 300 mg aa/kg diet + 0.03 % acify	1.74	1.75^{c}	1.87	2.17^{b}	2.7	2.05
LSD	ns	0.18	ns	0.22	ns	
CV %	4.87	5.23	3.51	5.51	9.79	
SEm ±	0.05	0.06	0.04	0.07	0.14	

Means within the column followed by the different superscript are significantly different ($P< 0.05$) by DMRT.

CONCLUSIONS

From this study, it was concluded that the better live weight gain was obtained when birds were fed diet with ascorbic acid in combination with 0.03 % acify. Hence in order to get better live weight gain, broiler ration could be incorporated with ascorbic acid 300 mg ascorbic acid/kg diet and acify (acidifier) 0.03 % through drinking water.. Considering better live weight gain, it can be inferred that organic acids can be used as an alternative to antibiotics in the diet of broiler chicken. However, further study would be necessary in order to confirm the results before recommending the technology to be adopted by the farmers.

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